

CHAPTER 2H  
LEVEE CONSTRUCTION AND  
EARTH EMBANKMENT CONSTRUCTION FOR DAMS

2H-01. GENERAL

This chapter covers all operations in connection with preparing the embankment, blanket foundations and placement and compaction of all permanent fills and backfills. If a conflict should exist between this guide and the contract specifications, the contract will govern. All conflicts will be reported to you: supervisor.

2H-02. GENERAL PROVISIONS

a. Lines and Grades

(1) Check extent of survey work to be performed by the contractor and by the Government.

(2) Check whether or not Government survey obligations have been met.

(3) Check, prior to start of work, location of vertical and horizontal control markers established by the Government.

(4) Check that work area limits are plainly marked prior to start of construction operations.

(5) Check work area limits against real estate property limits to determine ownership status.

(6) Check actual conditions of the site of the proposed work for agreement with the drawings.

(7) Check contractor's layout for accuracy, control and agreement with lines and grades on contract drawings.

(8) Check that original cross sections are taken before start of construction.

b. Conduct of the Work

(1) Check penetration of material, work and existing structures.

(2) Check that haul roads are approved prior to use and maintained during construction.

(3) Check rate of excavation from approved borrow sources or areas of required excavation.

(4) Check contractor's Environmental Protection Plan.

(a) Is stockpiling required?

(b) Do not permit unauthorized wasting or borrowing.

(5) Check on the type and frequency of tests the contractor is required to perform in accordance with the contractor's quality control plan. (QC)

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(6) Check on the type and frequency of tests the Government is to perform for quality assurance. (QA)

(7) Check to insure that contractor quality control tests and Government quality assurance tests are performed at the specified frequency.

c. Records

(1) Check with your supervisor prior to the start of work as to type of reports required, frequency, and data to be included.

(2) Check on reason for reports and end use.

2H-03. CLEARING AND GRUBBING

Refer to chapter 2A.

2H-04. STRIPPING

a. Area Limits - Check.

b. Use of Topsoil

(1) Check stockpiling or borrowing.

(2) Check work in place.

(3) Check wasting.

c. Stripping - Check depths.

d. Drainage Provisions - Check after stripping.

2H-05. FILL MATERIALS

a. General

(1) Check sources.

(2) Check material in place for classification.

(3) Check that unsuitable materials are not placed.

(4) Check various types of fills and the locations of each.

2H-06. EXCAVATION

a. General

(1) Check use of suitable materials.

(2) Check disposal of materials to be wasted.

(3) Check location of work limits,

(4) Check controls, horizontal and vertical.

(5) Check grades on "cut" stakes.

b. Specific

- (1) Check line and grade of foundation excavation.
- (2) Check excavated section of channels and ditches.
- (3) Check removal of unsuitable material.
- (4) Check fill material from borrow.
- (5) Check excavation areas for drainage.
- (6) Check use of interceptor ditches to control runoff.
- (7) Check finished slopes as excavation progresses.
- (8) Check slope tolerances as the work progresses.
- (9) Check for provisions and certification of monitoring equipment and operator.

c. Excavation Where Blasting is Employed

- (1) Check contractor's blasting pattern against contractor's approved plan.
- (2) Check use of test blasts before starting a full scale blasting program. Monitor the test blast program prior to full scale blasting, if required in the contractor.
- (3) Keep a record of quantity of powder used per blast, the number of the fuse delays used, blasting caps, and the depth and spacing of the holes.
- (4) Check finished slopes in the blasting area for fractures due to over blasting.
- (5) Check size of blasted rock.
- (6) Check on need of changing blasting pattern.
- (7) Check that requirements for monitoring blasts are being carried out.

2H-07. PREPARATION OF FOUNDATION

a. Fill - Fill depressions with soil material which is to be placed immediately above the foundation.

b. Loosen Soil Foundation - Check that the area is scarified, plowed or harrowed.

c. Cleanup - Check soil foundation is compacted after removal of roots or other debris turned up in the process of loosening.

d. Rock Foundation Preparation

- (1) Check that all loose material is removed.
- (2) Checks of area to be in contact with impervious materials.

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(a) Rock Surface - Thoroughly cleaned by washing and brooming.

(b) Cracks, joints and crevices cleaned out using air and/or air-water jets.

(c) Cleaned joints and cracks completely filled with portland cement mortar.

(d) Depressions or cavities satisfactorily filled with specified material and compacted. Cavities that cannot be satisfactorily filled with earth shall be filled with lean concrete according to specifications.

(e) No mortar of lean concrete applied or left on smooth rock surfaces.

(f) Remove all overhanging rock sections existing on the rock foundation excavated slope.

(g) Tie fill concrete to excavated rock face with anchors if and as required by specifications.

(h) Remove abrupt vertical changes in foundation slope as specified to preclude excessive differential settlement or stress concentrations.

## 2H-08. PLACEMENT

### a. Rolled Fill

#### (1) General

(a) Check embankment foundation prior to placement of fill and bonding of foundation material and fill.

(b) Check during placement that the embankment is free from lenses, pockets, streaks, and layers of material differing substantially in texture or gradation from surrounding material.

(c) Check that fill is not placed on frozen material, snow or ice, and that frozen earth is not placed in the embankment.

(d) Check grade of temporary construction slopes.

(e) Check types of materials:

1. Keep at same level unless otherwise specified.

2. Check mixing of materials.

(f) Check layer thickness and compaction of hand placed material.

(g) Check layer thickness and compaction of machine-dumped material and machine compaction.

(h) Check surface drainage of completed portions.

#### (2) Controlling Factors

(a) Check loose or compacted thickness of layers specified.

(b) Check material, being placed, for gradation at specific location.

(c) Check moisture content specified "after compaction".

(d) Check rate of placement.

(e) Check removal of oversize boulders.

(f) Check scarifying or wetting layers per specifications exclusive of the rock fill.

(g) Compaction by rolling Equipment - Check as follows:

1. Type of roller.

2. Number of passes.

3. Number of rows when tamping rollers used in tandem. Note limitation on tandem rollers in true alignment.

4. Overlap of each pass.

5. Method used when compaction by roller impossible.

b. Hydraulic Fill for Dams

(1) General

(a) Check for segregation during placement.

(b) Check gradation of materials.

(c) Check slopes of impervious central core and pervious shells.

(d) Check rate of construction.

(2) Controlling Factors

(a) Check gradation of the material being supplied for the sluicing or pumping.

(b) Check the gradation of material in the core.

(c) Check material in the shell.

(d) Check core width.

(e) Check core is free of sand lenses.

(f) Check location of discharge lines.

(g) Check consolidation of core.

(h) Check depth of core pool.

2H-09. MOISTURE CONTROL-ROLLED FILLED SECTIONS

a. General

(1) Check moisture content of materials to be placed.

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- (2) Check moisture content limits.

b. Impervious Sections

- (1) Check for dryness.
- (2) Check method of wetting:
  - (a) In borrow pit.
  - (b) On fill-Check uniform distribution.
- (3) Check for too wet material in fill. Dry each layer.
- (4) Check need for water meter.
- (5) Check moisture content after compaction.

c. Random Sections - Check that same control is used as for impervious material or pervious material.

d. Pervious Sections

- (1) Check that water is added after material has been spread on the embankment.
  - (2) Check method of wetting.
  - (3) Check that fines are not washed out when wetted.
- e. Filter Drainage Layers - No moisture control required.
- f. Rock Fill Sections-No moisture control required.

2H-10. COMPACTION

a. General

- (1) Check compaction requirements for various soils prior to start of work.
- (2) Check testing.
- (3) Check that compaction is obtained within moisture content limits.
- (4) Check to insure that the contractor's compaction effort is visually inspected at all times for the required number of passes of the compaction equipment.

b. Soil Types as Related to Compaction

- (1) Check specific types - Cohesionless, Cohesive and In Between
- (2) Check methods of compaction for various types.

c. Methods of Compaction - Compaction can be accomplished by the following methods:

- (1) Surface Rolling - Check that fills are built up in thin layers.

(2) Vibration - Check use for foundation work, utilizing thin layers and cohesionless soils.

(3) Water

(a) Check this method carefully on other than controlled hydraulic fill operation.

(b) Check for use in areas that cannot be reached by other methods.

d. Types of Compacting Equipment

(1) Tamping Sheepsfoot Roller

(a) Check for weight per linear foot of drum, weighted and empty.

(b) Check number of units.

(c) Check length and diameter of drums.

(d) Check length of projection of feet from drum.

(e) Check face area of feet.

(f) Check spacing and staggering of feet.

(g) Check device for cleaning feet.

(h) Check rolling units on multiple-type tamping rollers for use on uneven ground surfaces and independent rotation.

(i) Check speed of rolling.

(2) Rubber-tired Roller

(a) Check load per wheel.

(b) Check number of wheels.

(c) Check tires for size and operating pressures.

(d) Check position of wheels.

(e) Check spacing of wheels.

(f) Check speed of rolling.

(3) Crawler-Type Tractor

(a) Check size and weight.

(b) Check for use on cohesionless soils.

(4) Electrical Vibrators

(a) Check vibrations per minute.

(b) Check area of contact.

(c) Check thickness of layers.

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(5) Air Tampers

- (a) Check coverage by operator.
- (b) Check for use in restricted areas.
- (c) Check for thin lifts.

(6) Gasoline Driven Tamper

- (a) Check for use in trenches.
- (b) Check coverage by operator.
- (c) Check for thin lifts.

(7) Grid Roller

- (a) Check for use in highway work.
- (b) Check contact pressures.

(8) segmented Roller

- (a) Check for use on subbase and bases.
- (b) Check size.

(9) Vibratory Roller

- (a) Check weight and number of vibrations.
- (b) Check for use on cohesionless soils.
- (c) Check speed of rolling.

e. Moisture Density Relationship

- (1) Check relationship between moisture content and dry density under a given compactive effort.
- (2) Check results of laboratory data and field compaction.
  - (a) Check by field test section.
  - (b) Check by regular fill operation at start of job.

2H-11. HYDRAULIC FILL FOR LEVEES

a. Hydraulic Placement - Check method against approved plan of operations.

b. Outlets

- (1) Check that waste water is conducted away from embankment.
- (2) Check frequency of outlets.
- (3) Check that no obstruction is between end of discharge pipe and outlet.
- (4) Check for transverse retaining dike.



(5) Check pollution of stream at waste water outlet.

c. Damage - Check discharge of waste water.

d. Rehandling of Hydraulic Material

(1) Check method, non-compacted or semi-compacted.

(2) Check dryness of material.

#### 2H-12. DRESSING

a. Overbuilding of Embankment - Check that sufficient material is placed to permit settlement and dressing to grade.

b. Final Grade - Check full section obtained, considering tolerances.

c. Roughness of Surface - Check that surface is free of depressions and has uniform grade.

#### 2H-13. STONE PROTECTION

a. Material - Check stone against approval for quality and size.

b. Placement

(1) Check base for compaction and grade.

(2) Check depth.

(3) Check gradation after placement.

(4) Check surface grades.

c. Gravel Surfacing

(1) Check for gradation, coverage and depth.

(2) Check for segregation.

#### 2H-14. ZONING OF MATERIALS IN LEVEES

a. Homogeneous Material - Check use in section.

b. Nonhomogeneous Material

(1) Check use of impervious material.

(2) Check use of most pervious in landside berms.

(3) Check whether pervious or impervious to be used in riverside berms.

(4) Check soil type of riverside impervious facing.

#### 2H-15. GRADE TOLERANCE AND SHRINKAGE ALLOWANCE FOR LEVEES

a. Tolerances - Check permissible amount in final dressing.

(1) Check grade of crown and side slopes.

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(2) Check no abrupt changes or depressions.

b. Shrinkage Allowance

(1) Check shrinkage allowance for that portion constructed by the uncompacted fill method.

(2) Check shrinkage allowance for the portion constructed by the semi-compacted fill method.

2H-16. SETTLEMENT MONITORING DEVICES FOR LEVEES AND EMBANKMENTS

a. Installation - Check type, arrangement and spacing of these devices.

b. Records and Maintenance

(1) Check recording readings are taken.

(2) Require maintenance of devices during construction.

(3) Check payment provisions in event of failure.